

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Kahn *et al.*

Atty Dkt No.: 1324.029

Serial No.: Unknown, Continuation of PCT/GB99/03913

International Filing Date: 25 November 1999

Priority Data: GB 9825679.5 25 November 1998

GB 9914108.7 18 June 1999

Title: METHOD OF MODIFYING COMPONENTS PRESENT IN CASHEW NUT SHELL  
LIQUID

Assistant Commissioner for Patents

Box Patent Application

Washington, D.C. 20231

**PRELIMINARY AMENDMENT UNDER 37 CFR 1.115**

Dear Sir:

This paper is filed contemporaneously with a filing under 37 CFR 1.53(b). Prior to examination of this continuation application, please amend the priority application as follows:

**A. In the specification:**

**1.) Page 1, replace paragraph 1, lines 7-10 with:**

**-- Cross Reference to Related Applications**

This application is a continuation of co-pending International Patent Application Number PCT/GB99/03913, filed November 25, 1999, and claims priority from GB Patent Application Numbers 9914108.7, filed June 18, 1999 and 9825679.5, filed November 25, 1998. The entire disclosures of the prior applications are incorporated herein by reference.

**Field of the Invention**

This invention relates to a method of modifying components present in cashew nut shell liquid (CNSL), so as to improve its utilisation as a raw material for the formation of polymeric materials, particularly to be used as binders in the formation of composite products.

**Background of the Invention** --

**2.) Page 2, replace the first full paragraph (lines 4-6) with:**

-- It would be more commercially advantageous if CNSL could be converted to a form where it can be more easily dispersed in water, and made either wholly or partially water-soluble.

Summary of the Invention --

**3.) Page 3, replace paragraph 1 (lines 1-4) with:**

-- Detailed Description of the Invention

Accordingly, in one aspect of the invention, there is provided a process for modifying CNSL comprising subjecting the CNSL to ozonolysis to form ozonolysis reaction products followed by reduction of the ozonolysis reaction products to give a mixture of phenolic components and aldehydes. --

**4.) Page 11, replace paragraph 1 (line 1) with:**

-- Claims

We claim: --

**5.) Please insert the annexed new page 14, containing the following:**

-- Abstract of the Invention

Disclosed is a process for modifying cashew nut shell liquid (CNSL) which involves the steps of subjecting the CNSL to ozonolysis to form ozonolysis reaction products, followed by reduction of the ozonolysis reaction products to give a mixture of phenolic components and aldehydes. In a preferred embodiment, the process involves reacting CNSL with ozone to form

a mixture containing ozonolysis reaction products, and then treating the mixture under reducing conditions to form a further mixture containing phenolic components with an eight carbon chain having a terminal -CHO group and alkyl components of varying lengths with either one or two terminal -CHO groups. The resulting CNSL aldehydes may be used to form adhesives for use in the manufacture of composites such as wood particle board. --

**B. In the claims:**

**1.) Amended claims**

Please replace the parent PCT claims with the following clean version of claims, wherein claims 3, 7-8, 10-11, 15-16 and 19-21 are amended as shown in the subsequent version with markings.

**Clean Version of Pending Claims 1-21**

1. A process for modifying CNSL comprising subjecting the CNSL to ozonolysis to form ozonolysis reaction products followed by reduction of the ozonolysis reaction products to give a mixture of phenolic components and aldehydes.
2. A process for modifying CNSL which comprises the steps of first reacting CNSL with ozone to form a mixture containing ozonolysis reaction products, and secondly treating the mixture under reducing conditions to form a further mixture containing phenolic components with an eight carbon chain having a terminal -CHO group and alkyl components of varying lengths with either one or two terminal -CHO groups.
3. A process according to claim 1, wherein the ozonolysis reaction products are reduced using metals (such as transition metals) in the presence of acid, or reducing sugars, or catalytic hydrogenation, or reduction using a reducing agent selected from iodide (*e.g.*, sodium, potassium, calcium) in the presence of acetic acid; dimethyl sulphide; thiourea; triphenyl phosphine; trimethyl phosphate and pyridine.
4. A process according to claim 3, wherein the reducing agent is zinc and acetic acid.
5. A process according to claim 3, wherein the reducing agent is a reducing sugar such as alpha *D*-glucose.
6. A process for modifying CNSL, comprising the steps of first reacting CNSL with ozone to form a reaction product, and secondly treating the reaction product with a reducing sugar so as to form a mixture containing phenolic components with an 8 carbon chain having a terminal -CHO group, and alkyl components with either one or two terminal -CHO groups.

7. A process according to claim 1, wherein the ozonolysis is conducted in a solvent comprising an alcohol, preferably ethanol.
8. A process according to claim 1, comprising the further step, following the reduction step, of separating phenolic aldehydes and alkyl aldehydes formed during the process.
9. A mixture of alkyl aldehydes formed by the ozonolysis of CNSL and subsequent reduction of the resulting ozonolysis reaction products.
10. A method of converting CNSL aldehydes formed by a process as defined in claim 1, to an adhesive by treatment with an acidic material in the presence of water to form an emulsion, and thereafter further treating with a base.
11. An adhesive composition formed from the product of a process as defined in claim 1.
12. An adhesive composition according to claim 11, which is (i) produced by the treatment of CNSL aldehydes with an acidic material and/or (ii) formed by the treatment of CNSL aldehydes with a base.
13. An adhesive according to claim 12, which is formed by sequential addition of an acid and a base to CNSL aldehydes.
14. An adhesive according to claim 13, which is formed by the addition of *p*-toluene sulphonic acid to CNSL aldehydes, followed by the addition of solution of sodium hydroxide.
15. An adhesive according to claim 11, in the form of a solution or dispersion in water.

16. A method of forming a composite from a particulate or fibrous material (*e.g.*, a particulate or fibrous organic or inorganic material) comprising treating the material with CNSL aldehydes formed by a process as defined in claim 1, and heating to form the composite, optionally with the application of pressure.

17. A method according to claim 16, wherein the material is an organic material such as a lignocellulosic material, for example selected from wood, straw, hemp, jute, flax, rice straw and maize.

18. A method according to claim 16, wherein the material is an inorganic material selected from inorganic particulates and fibres, such as charcoal, marble (*e.g.*, crushed marble), crushed rock, clay, coal, slate and glass, *e.g.*, fibre glass.

19. A composite formed from a resin and a particulate and/or fibrous material wherein the resin is derived from the product of the ozonolysis and subsequent reductive cleavage of CNSL.

20. A composite according to claim 19, wherein the resin is an adhesive as defined in claim 11.

21. A composite according to claim 19, which is a wood particle board.

**Version with Markings to Show Changes Made  
(bolding indicates new text / [ ] indicates deleted text)**

A. In the specification:

- 1.) Page 1, the first paragraph is replaced with:

**Cross Reference to Related Applications**

This application is a continuation of co-pending International Patent Application Number PCT/GB99/03913, filed November 25, 1999, and claims priority from GB Patent Application Numbers 9914108.7, filed June 18, 1999 and 9825679.5, filed November 25, 1998. The entire disclosures of the prior applications are incorporated herein by reference.

**Field of the Invention**

This invention relates to a method of modifying components present in cashew nut shell liquid (CNSL), so as to improve its utilisation as a raw material for the formation of polymeric materials, particularly to be used as binders in the formation of composite products.

**Background of the Invention**

- 2.) Page 2, -- **Summary of the Invention** -- is added prior to the second full paragraph.
- 3.) Page 3, -- **Detailed Description of the Invention** -- is added prior to line 1.
- 4.) Page 11, -- **We claim:** -- is added prior to claim 1.

B. In the claims:

1.) Claims 3, 7-8, 10-11, 15-16 and 19-21 are amended as indicated below.

3. (once amended) A process according to claim 1 [or claim 2] wherein the ozonolysis reaction products are reduced using metals (such as transition metals) in the presence of acid, or reducing sugars, or catalytic hydrogenation, or reduction using a reducing agent selected from iodide (e.g. sodium, potassium, calcium) in the presence of acetic acid; dimethyl sulphide; thiourea; triphenyl phosphine; trimethyl phosphate and pyridine.

7. (once amended) A process according to claim 1 [any one of the preceding claims] wherein the ozonolysis is conducted in a solvent comprising an alcohol, preferably ethanol.

8. (once amended) A process according to claim 1 [any one of the preceding claims] comprising the further step, following the reduction step, of separating phenolic aldehydes and alkyl aldehydes formed during the process.

10. (once amended) A method of converting CNSL aldehydes formed by a process as defined in claim 1 [any one of claims 1 to 8] to an adhesive by treatment with an acidic material in the presence of water to form an emulsion, and thereafter further treating with a base.

11. (once amended) An adhesive composition formed from the product of a process as defined in claim 1 [any one of claims 1 to 8].

15. (once amended) An adhesive according to claim 11 [any one of claims 11 to 14] in the form of a solution or dispersion in water.

16. (once amended) A method of forming a composite from a particulate or fibrous material (*e.g.* a particulate or fibrous organic or inorganic material) comprising treating the material with CNSL aldehydes formed by a process as defined in **claim 1** [any one of claims 1 to 8] and heating to form the composite, optionally with the application of pressure.

19. (once amended) A composite formed from a resin and a particulate and/or fibrous material [ (*e.g.* a particulate material and/or fibrous material as defined in any one of claims 16 to 18) ] wherein the resin is derived from the product of the ozonolysis and subsequent reductive cleavage of CNSL.

20. (once amended) A composite according to claim 19 wherein the resin is an adhesive as defined in **claim 11** [any one of claims 11 to 15] .

21. (once amended) A composite according to claim 19 [or claim 20] which is a wood particle board.

Remarks

The parent PCT application includes claims 1-21, and all remain pending.

Amendments to Specification

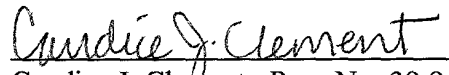
The specification has been amended to include Applicants' claim for foreign priority, to include an Abstract on a separate page, and to include section headings where appropriate.

A clean copy of the pending claims and a copy of the amended paragraphs of the specification with markings to show the changes, are provided herein.

Applicants respectfully request examination and consideration of claims 1-21.

Respectfully submitted,

Date: May 25, 2001

  
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Abstract of the Invention

Disclosed is a process for modifying cashew nut shell liquid (CNSL) which involves the steps of subjecting the CNSL to ozonolysis to form ozonolysis reaction products, followed by reduction of the ozonolysis reaction products to give a mixture of phenolic components and aldehydes. In a preferred embodiment, the process involves reacting CNSL with ozone to form a mixture containing ozonolysis reaction products, and then treating the mixture under reducing conditions to form a further mixture containing phenolic components with an eight carbon chain having a terminal -CHO group and alkyl components of varying lengths with either one or two terminal -CHO groups. The resulting CNSL aldehydes may be used to form adhesives for use in the manufacture of composites such as wood particle board.